STRUCTURE OF MULTI-QUASIPARTICLE ISOMERS IN THE REGION OF ^{177}Lu

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The region of deformed nuclei near Z = 72 and N =104 is known to be prolific in terms of high-K isomers, formed by combining high-Ω orbitals present near both proton and neutron Fermi surfaces. Although some profound examples are known, including the 31-year isomer $K^\pi = 16^+$ in ^{178}Hf and the 160-day $K^\pi = 23/2^-$, β-decaying isomer in ^{177}Lu, many more are predicted in the region near the stability line, but very few are accessible by conventional fusion-evaporation reactions. Multi-nucleon transfer or "deep-inelastic" reactions, however, offer an alternative, if non-selective, means of accessing such nuclei [1].

We have carried out experiments using Gammasphere and 820 MeV ^{136}Xe beams incident on several targets including enriched ^{176}Lu, with the dual aims of studying the structure of nuclei such as ^{176}lu, which is of interest as an s-process chronometer, and of identifying high-seniority states in ^{176}Lu and the surrounding nuclei. The approach adopted is to use time-correlations to identify and thus characterise both new isomers and their associated collective bands.

New results include identification of the predicted 7-quasiparticle $K^\pi = 39/2^-$ isomer in ^{177}Lu [2], a 7-quasiparticle $K^\pi = 49/2^+$ isomer in ^{179}Ta with an anomalously fast decay [3], and numerous other examples in a range of Yb, Lu and Ta nuclei. The ^{177}Lu state is that which has also been proposed as the source of an observed but not directly assigned β-decay [4]. The results will be discussed in both an experimental context involving complementary studies such as incomplete fusion reactions, and in terms of the information they provide on the structure and possible extent of high-K multi-quasiparticle states, the coupling to rotational motion, and the factors which govern the purity, or otherwise, of the K-quantum number.

This work was supported by the ANSTO program for Access to Major Research Facilities, grant No. 02/03-H-05, the Australian Research Council projects DP0343027 and DP0345844, and the US Department of Energy, Office of Nuclear Physics, under Contract No. W-31-109-ENG-38, and Grant No. DE-FG02-94ER40848.

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